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The invention provides improved biocompatible implant alloys and methods of constructing artificial implants having improved long term wear properties. Cobalt-base biocompatible implant alloys provided according to the invention are essentially free of carbide, nitride and sigma second phase particles, and can have hardness and strength properties equivalent to or greater than the standard CoCrMo alloy with significantly improved fatigue life and superior frictional contact properties with UHMWPE. Artificial implant constructions and methods provided according to another aspect of the invention are capable of eliminating latent defects that can promote long term failure of joint implants.

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